Bay Area Regional High-Occupancy Toll (HOT) Lanes Feasibility and Implementation Study

Oversight Committee Briefing Materials
December 6, 2006

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Study Purpose

- Transportation 2030 proposes converting existing HOV lanes to HOT lanes and expanding the HOV/HOT system where possible

- Current study aims to
  - Determine whether regional HOT network is feasible; assess whether revenues from a regional network help fill gaps in and extend the HOV/HOT system
  - Define a phased implementation plan
  - Provide regional context for demonstration projects under development in Alameda and Santa Clara counties
  - Inform regional policies related to HOT lane implementation

A Proven Concept

- Individual HOT lanes operate successfully in several US cities

Orange County, CA	Minneapolis, MN (2005)
San Diego, CA	Denver, CO (2006)
Houston, TX	

- Demonstrated benefits include
  - More efficient use of freeway capacity
  - Reliable option for carpoolers, express bus riders and those who choose to pay the toll for any given trip (“congestion insurance”)
  - Broad public acceptance (and usage) across income groups
  - Neutral (or positive) impact on carpooling and express buses
  - Revenues typically cover O&M costs and may help fund HOT lane construction, express bus operations and other improvements

Study Approach

Regional Network Overview

- Identify regional and network policy considerations
- Assess costs, benefits and financial feasibility at broad level
- Define phased implementation plan

Future phases would include:

- Refined analysis of costs & revenues, traffic operations and equity
- Assessment of public/stakeholder opinion
- Project development – engineering and environmental studies

Policy guidance: MTC, Caltrans and BT&H

Technical guidance:

Steering Committee – MTC, Caltrans, CHP, ACCMA and VTA

Oversight Committee – partner agencies, MTC Advisory Council, public interest groups and business community

Progress to Date

Policy considerations	§ Reviewed initially by Oversight Committee (3/06) § Documented in Task 4 report § Presented to Oversight Committee and MTC Planning Committee (12/06)
Costs, benefits & financial feasibility	§ Preliminary analysis complete – costs, revenue & financial feasibility; tolls and traffic impacts § Documented in Task 3 report § Presented to Oversight Committee and MTC Planning Committee (12/06) § Refined analysis may be warranted
Phased implementation plan	§ To be developed

Analysis Framework

- Two HOT networks considered (see figs. 1 & 2)

  Existing and Funded Network – convert HOV lanes existing and under construction and those funded in the 2007 TIP; analyze for 2015 and 2030

  Connected Network – fill gaps and extend the HOV/HOT system; 2030 only

- Tolling
  - Maintain level of service C in HOT lanes: tolled vehicles not allowed in if volumes exceed 1,600 vehicles per hour (vph)
  - Toll to maximize person travel time savings subject to 1,600 vph limit
  - No pre-set maximum toll (see what market will bear)
  - Full time (24/7) tolling (sensitivity test for reduced hours)

- I-680 Sunol design principles; similar to Minneapolis (see fig. 3)
  - Double yellow line separates HOT lane from mixed flow lanes
  - Multiple entrances and exits within each corridor

Fig. 1
Existing and Funded Network

Fig. 2 Connected Network

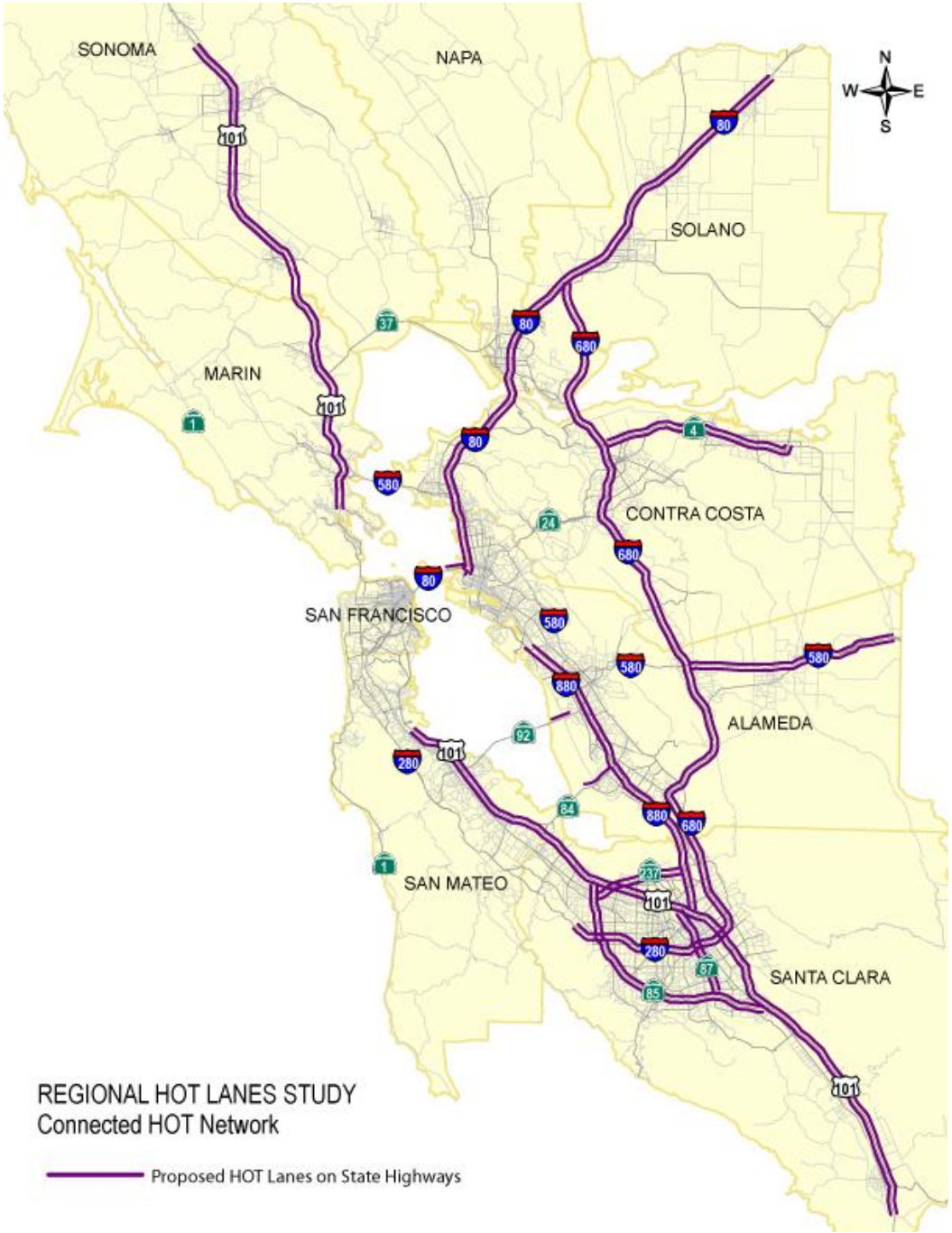
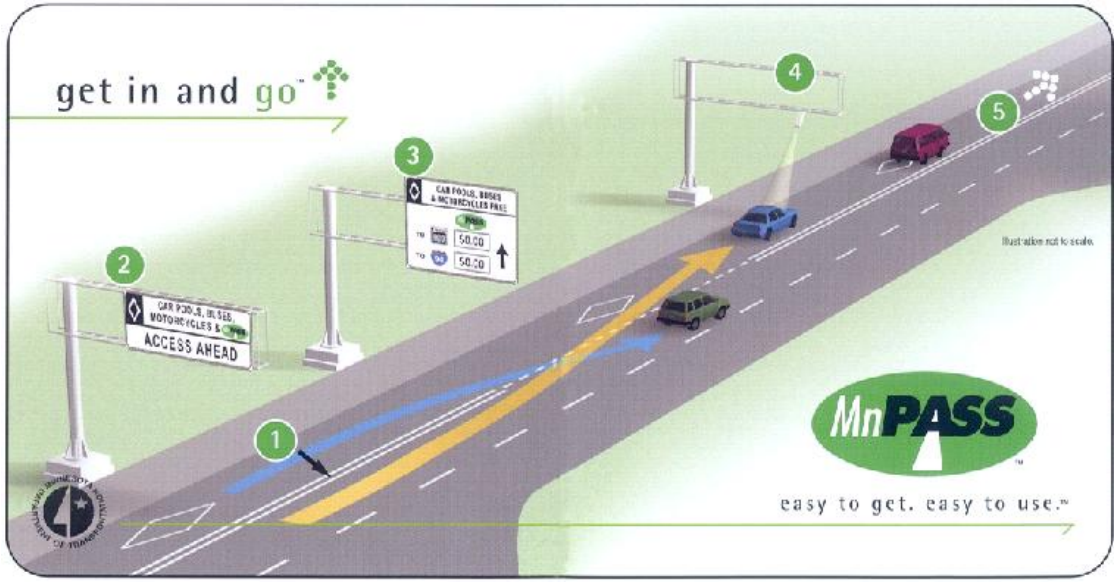
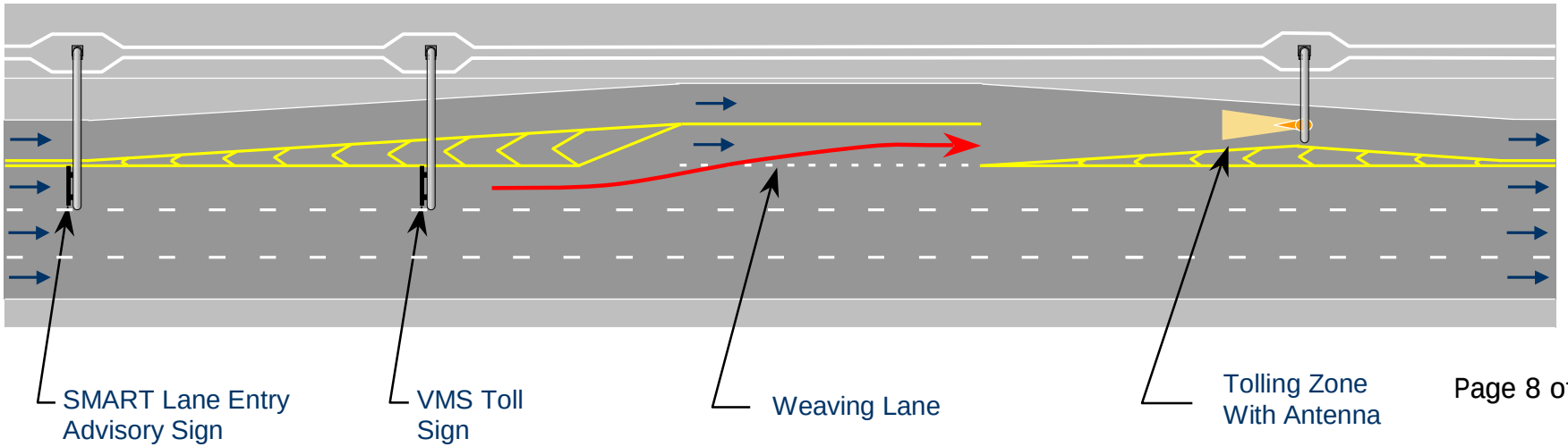


Fig. 3 Design Principles

HOT lane separation



Entrance design
(exits are designed with similar weaving lanes)



Future HOV Lane Volumes (see fig. 4)

- HOV lanes are becoming increasingly crowded over time; as they fill, HOV lanes will no longer provide advantages

  HOV lanes approaching level of service C:

  By 2020
  - I-80 (Alameda and Contra Costa)
  - I-580
  - I-680 (Contra Costa)
  - SR 85

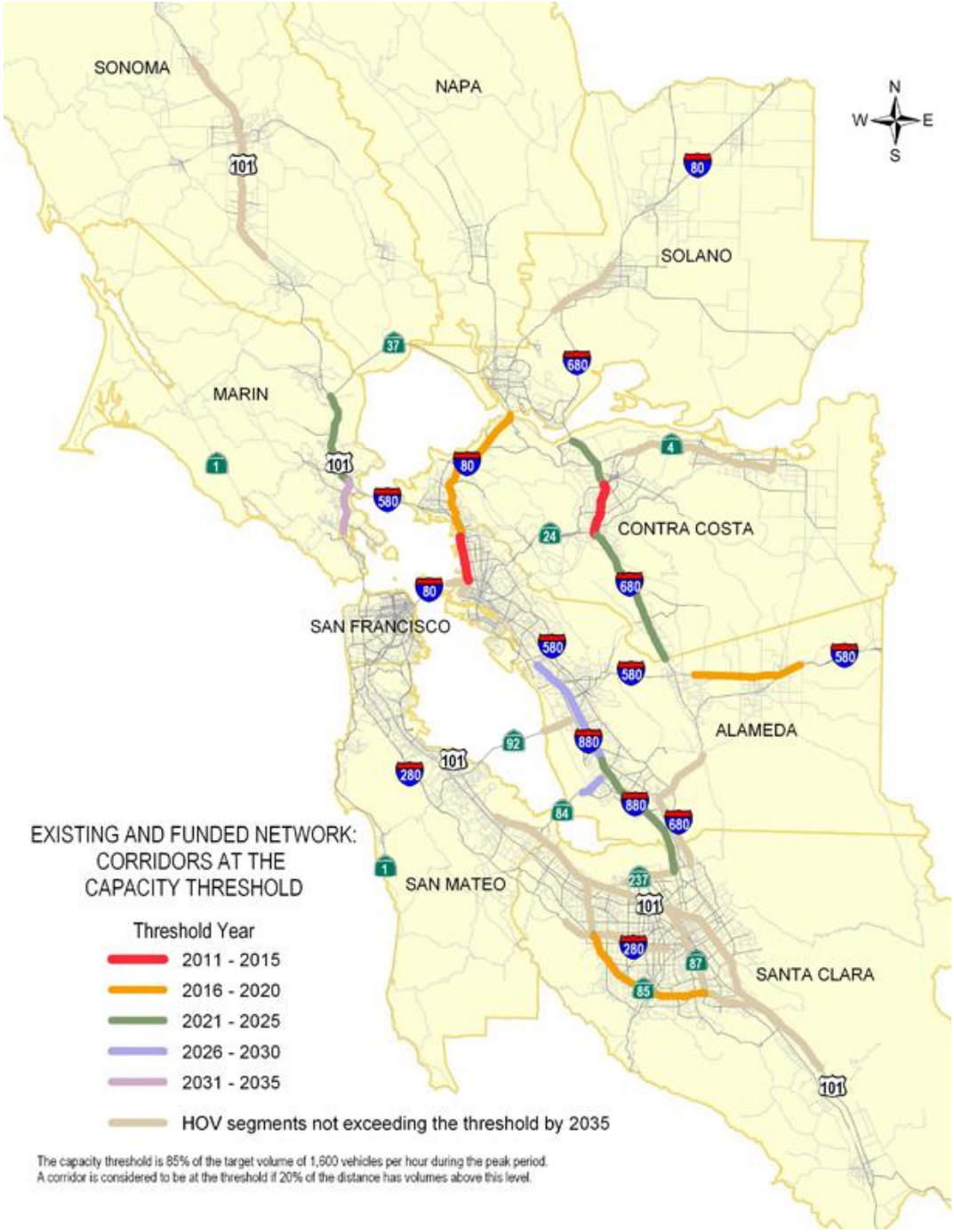
  By 2030
  - I-880
  - US 101 (Marin and Sonoma)

- Current projections show this happening more slowly than previously believed in 2002 HOV Master Plan Update

  Reflects more cautious economic projections and smarter growth principles

- Could implement HOT lanes allowing 2-person carpools to travel free of charge in may corridors, at least initially

Fig. 4
HOV Lanes Becoming Crowded Over Time



Capital Costs

(all figures in 2006 dollars; see Appendix 1 for capital costs by corridor)

Range of unit costs to convert existing HOV lanes to HOT lanes*

Low:	$1.4 mill/lane mile	Good knowledge of ROW and no widening or structure modification needed; 20% contingency
Medium:	$2.2 mill/lane mile	Good knowledge of ROW and minimal widening or structure modification needed; 30% contingency
High:	$3.7 mill/lane mile	Limited knowledge of ROW or significant widening/ structures modification needed; 50% contingency

* Consistent with I-680 design principles (i.e., standard shoulders, 4-foot buffer between HOT and mixed flow lanes; additional width for weaving lanes at HOT lane entrances/exits, and CHP enforcement areas) and do assume no design exceptions. Includes traffic management during construction.

Total Cost - Existing and Funded Network: $1.2 billion
(cost to convert HOV lanes to HOT lanes)

Incremental Cost - Connected Network: $3.5 billion
(cost to fill gaps & extend HOV/HOT system; includes widening)

Central System Costs

(all figures in 2006 dollars)

Include:

- BATA customer service center start-up costs ($1 million, one-time cost)
- Toll transaction processing fees to BATA ($0.16 per transaction)
- Transaction processing fees to banks (2.2% of transaction cost)
- Transponder purchase and replacement ($18 per transponder)

Operations and Maintenance (O&M) Costs

(all figures in 2006 dollars)

$70,000 per lane mile per year, includes:

- Enforcement
- Communications between field equipment and central tolling system
- Maintenance of HOT equipment
- Administration

Total Annual O&M Cost
Existing and Funded Network: $34 million

Incremental Annual O&M Cost
Connected Network: $21 million

HOT Lane Forecasting Overview

(See Appendix 2 for more detail)

HOT lane demand, toll levels and revenue modeled using the Toll Optimization Model (TOM), which pivots of MTC travel forecasts

- Existing and Funded HOT Network: 2015 and 2030
- Connected HOT Network: 2030 only
- Tolls set to maximize value of travel time savings subject to 1,600 vehicle per hour maximum in the HOT lanes (carpool volumes unconstrained)
- Two free-vehicle policies considered: (a) 2 or more persons per vehicle and (b) 3 or more persons per vehicle
- Expand peak period to annual forecasts (all day, all week) using current traffic data
- Future refinements will include feedback with MTC travel model to account for shifts in routes, trip times and mode choice in response to tolls and restricted access locations.

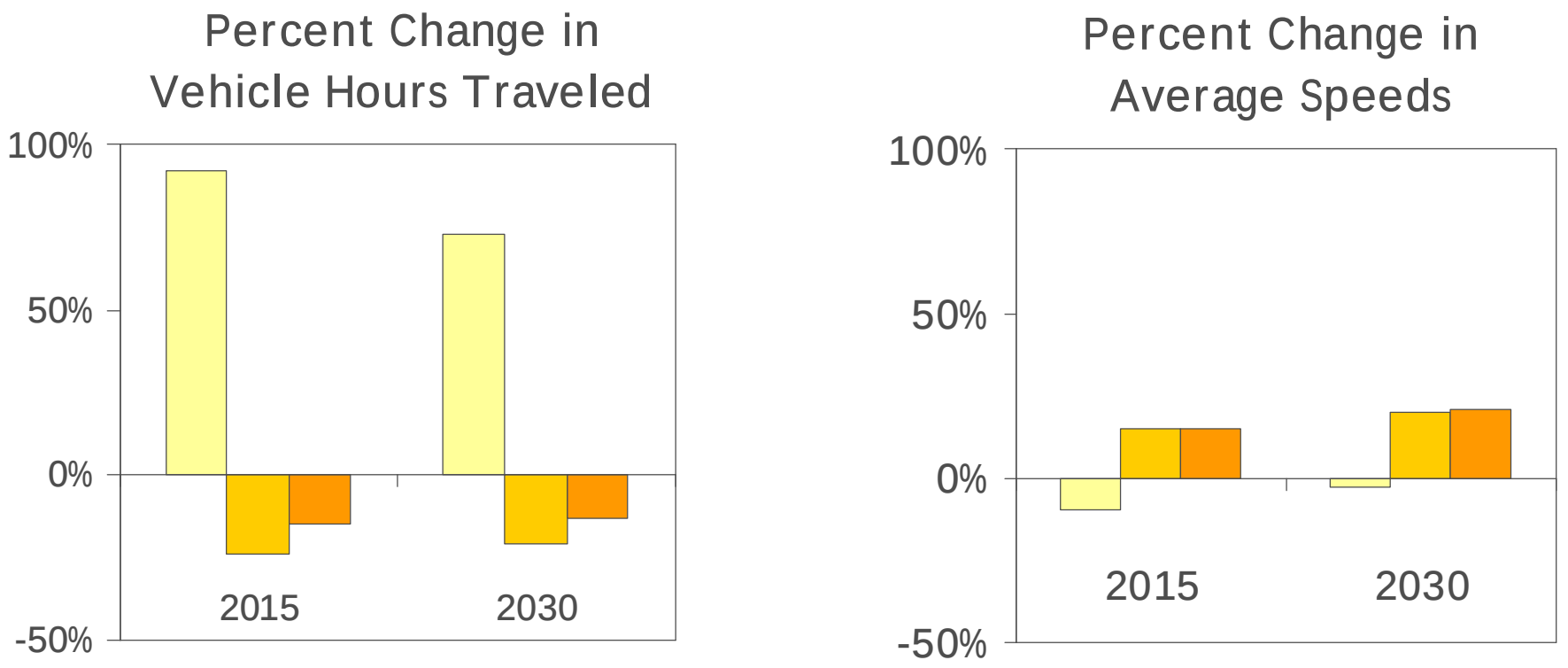
Traffic Impacts – Preliminary Analysis

(see fig. 5 and Appendix 3)

Compared to HOV only, HOT networks:

- Decrease total freeway vehicle hours of travel (VHT) 13% to 15%
- Increase average freeway speeds 15% to 21%
- In HOV/HOT lane, increase in VHT and slight decrease in speeds due to addition of tolled vehicles; however, tolling policy assures volumes do not exceed level of service C and keeps speeds above 50 mph on average.
- No change in VMT as vehicles just shift between lanes
- Results are preliminary; may be less robust after refinements that account for shifting from arterials and shoulders of peak period
- Still, consistent with results in Minneapolis where speeds in the general purpose lanes increased by 2% to 15% with the HOT lane

Fig 5 Traffic Impacts of HOT Network Compared to HOV-only Network



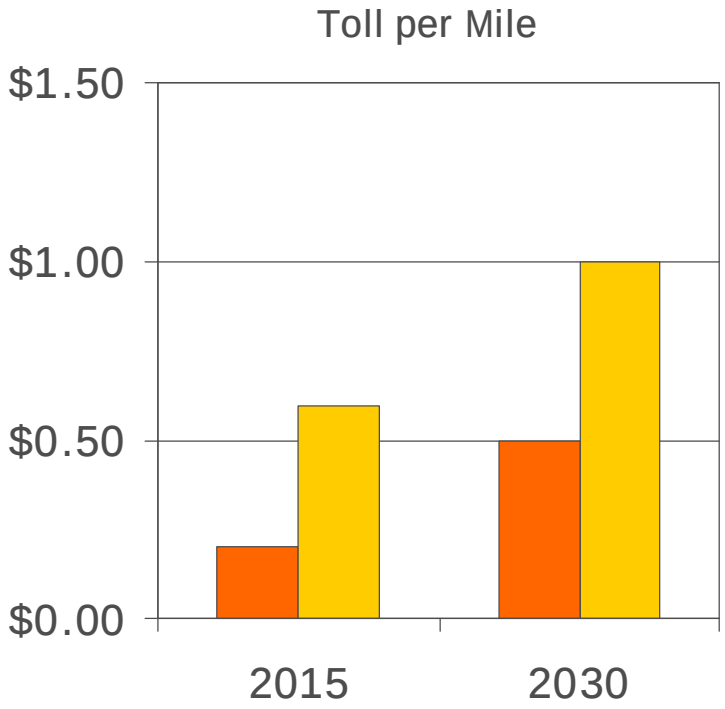
Note:
Figures for 2015 are for Existing and Funded Network; figures for 2030 are for Connected Network

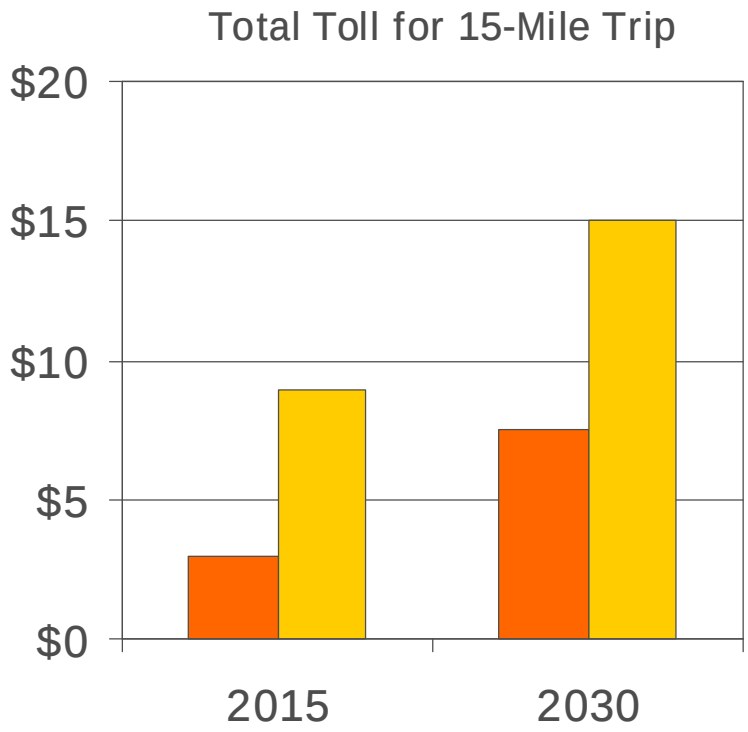
Typical Peak Period Tolls

(see fig. 6)

- Travelers would typically pay 20 to 60 cents per mile in 2015 and 50 cents to $1 per mile in 2030 (during peak periods)
- For 15-mile trip (average trip length for carpoolers), this equates to $3 to $9 in 2015 and $8 to $15 in 2030
- Peak tolls per mile on transbay bridge approaches tend to be higher as drivers are willing to pay a premium to avoid toll booth delays
- These figures, while in 2006 dollars, reflect higher levels of traffic congestion than we see today
- Typical maximum peak tolls on other facilities in 2006:
  - San Diego, 50 cents per mile
  - Orange County, 85 cents per mile

Fig 6 Typical Peak Period Tolls





For peak direction of travel

Less Congested (low end of range) More Congested (high end of range)

Note:
Figures for 2015 are for Existing and Funded Network; figures for 2030 are for Connected Network

Revenue (1)

	Existing HOV Occupancy Requirements (2)	Increase HOV Occupancy Requirements in Select Corridors (3)
Existing and Funded Network		
Total annual revenue in 2015	$148 to $185 M	$180 to $226 M
Total annual revenue in 2030	$323 to $404 M	$401 to $502 M
Connected Network		
Total annual revenue in 2030	$320 to $400 M	$596 to $745 M

Notes:

(1) Revenue is presented as a range to account for lack of feedback with travel demand model.

(2) 2-person vehicles qualify as HOVs in all corridors except: I-80 ALA-CC and I-880 NB approach to the Bay Bridge

(3) Increase HOV occupancy requirements to 3+ in corridors where HOV volumes would otherwise approach LOS C. Corridors approaching LOS C by 2020 in the Existing and Funded Network include: I-580 and I-680 CC. For the Connected Network, additional corridors approaching LOS C by 2030 include: I-880 ALA-SCL and US 101 MRN-SON

Revenue Sensitivity Analyses

Sensitivity analysis conducted to assess impact of tolling policy variations:

	Impact on Total Revenue*
Permit hybrids to use HOT lane free of charge (impact depends on number of carpools and congestion in mixed flow lanes; larger impact with more carpools and more congestion as hybrids replace tolled vehicles that would be paying high tolls.)	-5% to -40%
Toll during peak congested periods only (defined by V/C ratio; includes weekdays and weekends)	
12 peak hours/day	-5%
8 peak hours/day	-20%
4 peak hours/day	-52%
Toll to maximize revenue rather than travel time savings (still subject to 1,600 vph maximum)	+20%

* Average expected impact on total revenue; impact may be higher or lower depending on the specific corridor

Revenues Compared to Costs – Network Totals

(see table next page)

A regional HOT network appears to be financially feasible

- Revenues from the Existing and Funded Network would cover costs and could generate $2 to $4 billion in net revenue over 30-years (present discounted value, assuming 4% discount rate)

- This is likely sufficient to cover a significant portion of the HOV/HOT lane expansion associated with the Connected Network ($3.5 billion)

- While 30-year revenues have not been developed for the Connected Network, revenues in 2030 would cover costs – but only if HOV occupancy is increased in corridors where HOV volumes are approaching LOS C levels.

Revenues Compared to Costs – Network Totals

	Existing HOV Occupancy Requirements (2)	Increase HOV Occupancy Requirements in Select Corridors (3)
Existing and Funded Network – 30-Year Net Revenue (1)		
Revenues	$3.8 to $4.7 B	$4.4 to $5.6 B
Costs	$1.5 B	$1.5 B
Net Revenue	$2.3 to $3.2 B	$2.9 to $4.1 B
Connected Network – Annual Net Revenue, Year 2030		
Revenue	$322 to $402 M	$598 to $747 M
Costs (4)	$342 M	$342 M
Net Revenue	-$20 to $60 M	$256 to $405 M

(1) Present discounted value of costs and revenues from 2015 to 2045, assuming 4% real discount rate

(2) 2-person vehicles qualify as HOVs in all corridors except: I-80 ALA-CC and I-880 NB approach to the Bay Bridge

(3) Increase HOV occupancy requirements to 3+ in corridors where HOV volumes would otherwise approach LOS C. Corridors approaching LOS C by 2020 in the Existing and Funded Network include: I-580 and I-680 CC. For the Connected Network, additional corridors approaching LOS C by 2030 include: I-880 ALA-SCL and US 101 MRN-SON

(4) Amortized capital cost plus one year of O&M cost

Revenues Compared to Costs – by Corridor

(see figs. 7 & 8 and Appendix 4)

- Some corridors generate substantial net revenue, while many break even or fall slightly short.

- Corridors with net revenue in excess of $300 million over 30 years include:
  - I-680 over the Sunol Grade (ACCMA & VTA pursuing);
  - SR 85 in Santa Clara (VTA pursuing);
  - US 101 in Santa Clara and San Mateo (VTA pursuing Santa Clara portion);
  - I-680 in Contra Costa (if HOV occupancy increased);
  - I-880 in Alameda and Santa Clara
  - I-80 in Alameda and Contra Costa

- This suggests a regional network is financially feasible only if revenues can be applied flexibly throughout the system

Fig. 7
Existing and Funded Network Revenues Compared to Costs

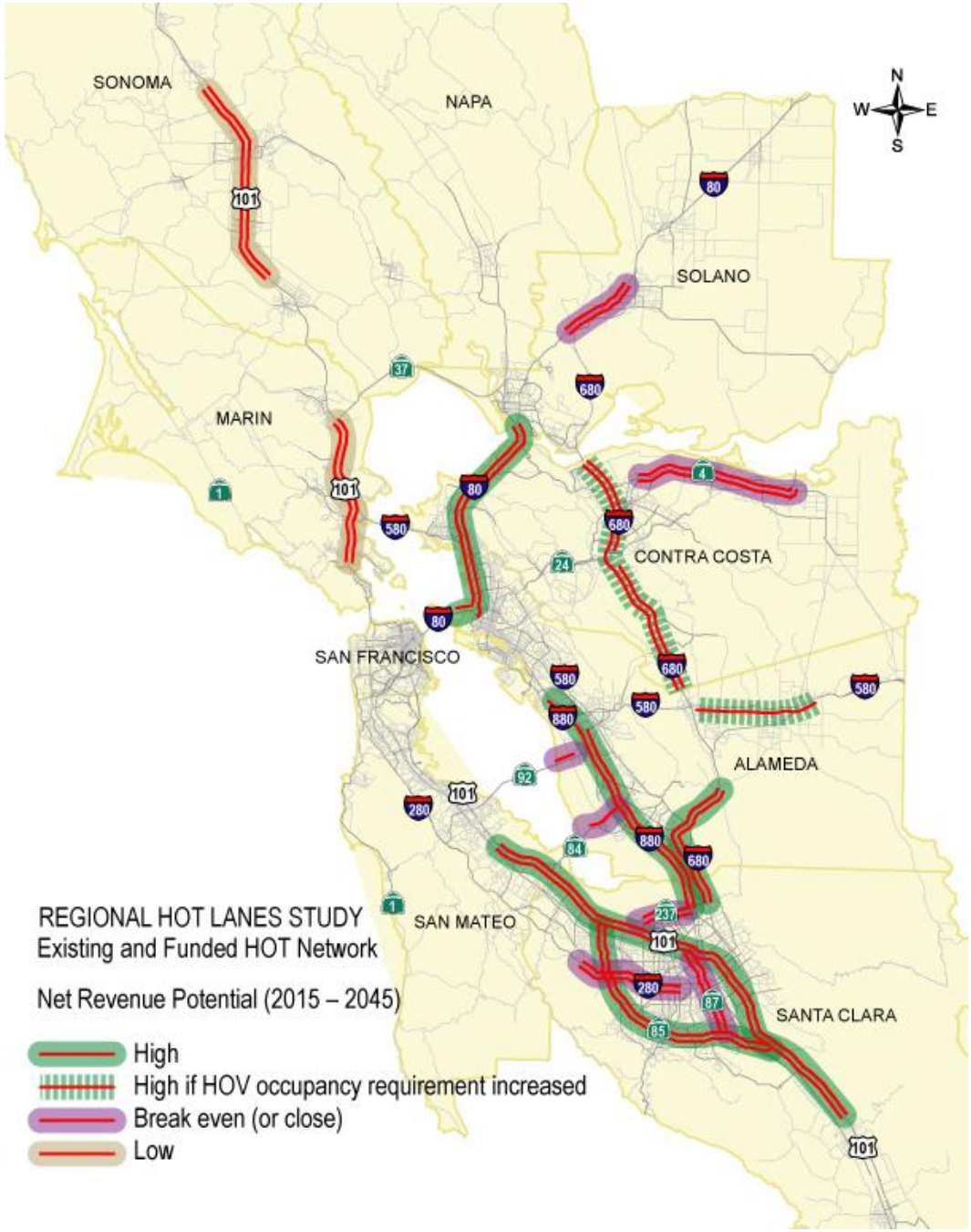
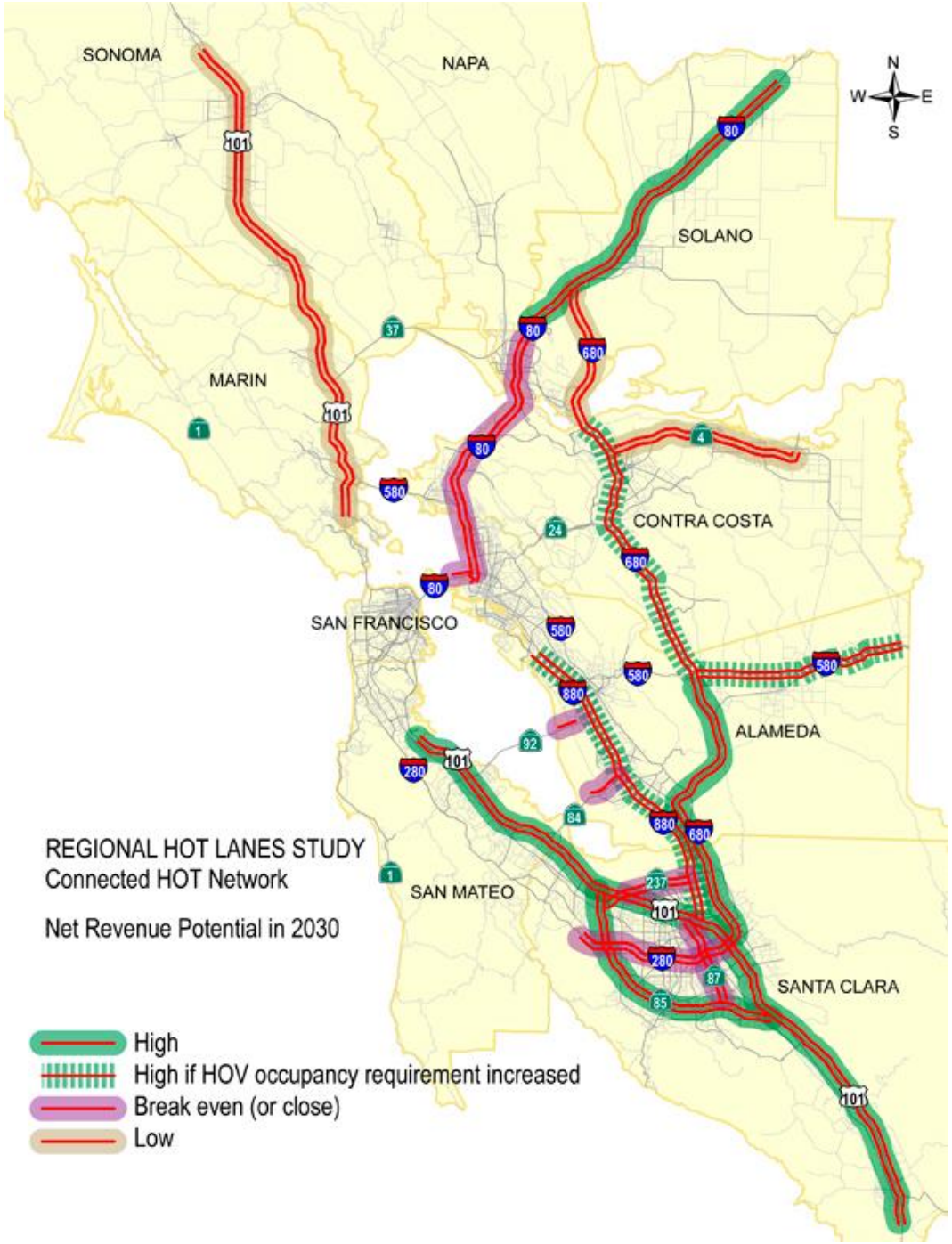


Fig. 8
Connected Network Revenues Compared to Costs



Policy Considerations

- The Oversight Committee reviewed several major policy areas earlier this year (see Appendix 5 for a summary of March 29, 2006 workshop)
  - **Governance and revenue allocations**
  - **Eligibility and tolling**
  - Access
  - Enforcement
  - Equity

- All of these remain important; however, the first two jump to the forefront in light of technical findings to date.

- We expect these to be prominent as policy boards review findings in December (MTC) and early next year (Caltrans, BT&H)

Governance and Revenue Allocation

A true regional HOT lane network is feasible only if revenues can be applied flexibly throughout the system

Issues

- Politically challenging
- Current legislation requires excess revenue be invested within the corridor of origin
- More analysis may be helpful to understand
  - Whether revenues in the most remunerative corridors are sufficient to fund improvements with excess remaining to support other corridors
  - Extent to which revenues from the Connected Network are sustained over time and can cover costs of expanding the HOV/HOT network

Eligibility and Tolling

Issues

- **Toll levels**

  Effective HOT lanes require that toll levels be determined by market forces (no a priori maximum). This does not mean giving up policy control or open, public process (SR 91 has adopted procedures that specify the maximum frequency and amount of toll increases)

- **Full-time vs. part-time tolling**

  Bay Area HOV lanes currently operate during peak commute hours only. There are operational and revenue advantages to operating HOT lanes during peak travel times (e.g., weekends in some corridors) if not full-time. Reactions in other areas with HOT lanes has been mixed.

- **HOV occupancy**

  HOV/HOT lanes will not achieve their objectives (increased efficiency, encouraging carpooling) if HOV volumes grow to a point where the lanes are congested. In some cases, it may be possible to add a second HOV/HOT lane when this occurs; however, in most corridors, the most cost-effective way to restore efficiencies will be to increase the HOV occupancy requirement. One possible solution is to offer reduced tolls to 2-person carpools during the height of the peak period (SR 91 does this).

Next Steps

(not necessarily in order listed)

- Policy boards briefed on findings to date
  - MTC Planning Committee (December 8)
  - Caltrans, BT&H officials (February)
- Analyze financing options
- Develop conceptual phased implementation plan outlining steps to develop regional network
- Refinements to costs, revenues and traffic
- Further discussion on key policy concerns